

## POLARIMETRY OF COMET C/1996 B2 HYAKUTAKE AND POLARIZATION MAXIMUM OF DUSTY COMETS.

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**Observations:** Polarimetry and photometry of the comet C/1996 B2 Hyakutake were carried out with the 70-cm reflector (f/16) of Kharkov University Observatory from March 25 to April 7, 1996. The comet was observed with a set of narrow-band comet filters. The ultraviolet, blue, and red continuum filters centered at 3650, 4845, and 6840 Å and the molecular band filters for  $C_3$  at 4060, and  $C_2$  at 5140 Å were used. The diaphragm size was 88 arc sec. The phase angles of the comet changed in the intervals 57.7–111.1°.

**Results:** The phase dependence of polarization of the comet Hyakutake in blue and red continuum filters is shown in Figs. 1–2, respectively. The approximation of these data by the third degree polynome provides  $P_{\max}$  and  $\alpha_{\max}$  of 24.0%, 93.6° and 26.5%, 93.9° in the 4845 Å and 6840 Å filters, respectively. According to the results of our photometry gas-to-dust ratios  $W_{4845}$  were 139 Å on March 25 and 265 Å on April 5. These values are small ones therefore we conclude that the comet has strong continuum. Because of this the depolarizing influence of the molecular emissions was negligibly small on polarimetric data in the continuum filters and hence the position of the polarization maximum depends only upon the properties of the dust particles of the comet. By contrast of this the leak of cometary continuum in the 5140 Å filter was perceptibly large. In response to this the degree of polarization  $P_{\max}$  was 15.0% at phase angle of 88.9°. This is nearly two times larger than the expected polarization degree  $P_{\max} + 7.7\%$  because of the resonance fluorescent mechanism of scattering. In the same Figs. 1–2 the relevant polarimetric data of several comets are given [1]. As it can be seen, the polarization data for the comet

Hyakutake are in good agreement with the data for the dusty comets in the 57°–73° crossed region and these data complement each other very well. The BC-RC color of comet Hyakutake was in the range of  $0.1 \pm 0.1$  mag. Again, it is close to the colors of the dusty comets as it was found in [2]. Consequently, the comet Hyakutake belongs to the group of the dusty comets as well polarimetrically as colorimetric properties of its dusty particles. In such a case, taking into consideration [1], the complete phase dependence of polarization of the dusty comets can be obtained for two continuum domains in the phase angle interval 0°–111°. Their parameters are:  $P_{\min} = -1.5\%$ , independent of wavelength,  $\alpha_0 = 22.1^\circ$ ,  $h = 0.34$ ,  $P_{\max} = 224.0\%$  and  $\alpha_{\max} = 94^\circ$  for blue filter and  $\alpha_0 = 22.1^\circ$ ,  $h = 0.41$ ,  $P_{\max} = 26.6\%$  and  $\alpha_{\max} = 94^\circ$  for red filter.

**Discussion:** Until the present time the position and the value of the maximum of the polarization cometary continuum were undetermined. There was only a limited number of polarimetric observations at phase angles larger than 90°. A lot of them were carried out in rather wide wavelength intervals using quite wide-band filters. The scattering of gas-to-dust ratios among the comets and the problem of a gas contamination in the continuum filters complicates the study of polarization phase dependence of comets. Previously, it was supposed that maximum of cometary polarization lies near 90° [3] or corresponds to the polarization maximum of atmosphereless bodies. We have found that the maximum of polarization of the dusty comets occurs at about 94° and  $\alpha_{\max}$  is almost independent on a wavelength at least in the visible region of spectra but the values of  $P_{\max}$  decrease in the blue one. By contrast to the comets, the

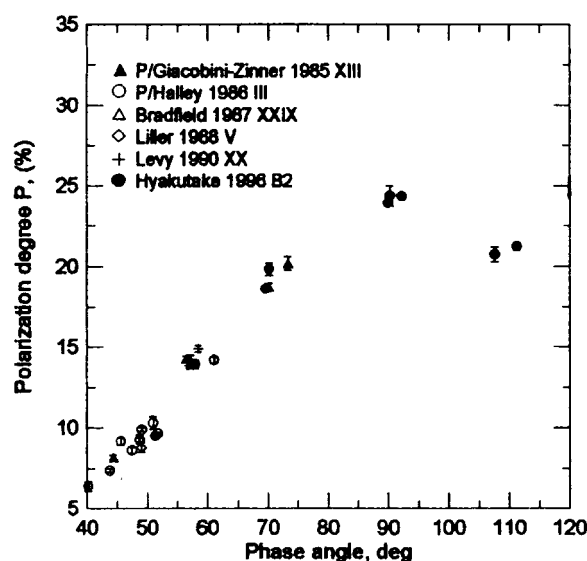


Fig. 1. Polarization phase dependence of dusty comets in the BC filter.

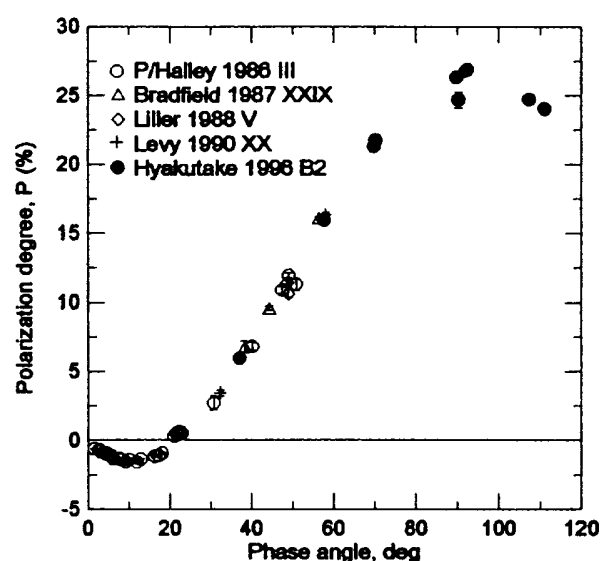


Fig. 2. Synthetic curve for polarization of dusty comets in the red domain.

polarization maxima of the atmosphereless bodies of S type (the whole Moon, Mercury, and NEAs) are close to 9% and lie in the region of  $100^{\circ}$ – $110^{\circ}$ , according to [4–6]. The  $P_{\max}$  is greater in the blue domain than in the red one. The maximum of polarization of the Zodiacal light also falls in this region [7]. The position and the degree of the polarization maximum of the C type asteroids are unknown. So, in spite of “asteroid-like” form of the polarization phase dependence of the dusty comets, their parameters are really different from the asteroids. Now the parameters of the whole phase dependence of polarization obtained from the ground-based observations should be taken into consideration by the models of cometary dust particles.

**Conclusion:** It is shown that the comet Hyakutake belongs to the group of the dusty comets. The position and the degree of polarization maximum for the comet

Hyakutake and hence for the group of the dusty comets was found for blue and red domains of continuum for the first time. Consequently, at present the complete phase dependence of polarization of the dusty comets is known in the interval  $0^{\circ}$ – $111^{\circ}$ . The  $\alpha_{\max}$  depends slightly on wavelength and the values of  $P_{\max}$  increase in the red.

**References:** [1] Chernova G. P. et al. (1993) *Icarus*, 103, 144. [2] Kolokolova L. et al. (1997) *Icarus*, in press. [3] Dubrovolsky O. V. et al. (1986) *Earth, Moon, Planets*, 34, 189. [4] Dollfus A. and Bowell E. (1971) *Astron. Astrophys.* 10, 29. [5] Dollfus A. and Auriere M. (1974) *Icarus*, 23, 465. [6] Kiselev N. N. et al. (1990) *Kinematika Fiz. Netesn. Tel.* 6, 77. [7] Lamy P. L. (1985) in *Proceeding of a meeting held in the Astronomical Observatory of Uppsala University, June 3–6*, 373.